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THE HYGRODEIK AND THE PROPER MEANS OF HYDRATING OUR HOUSES AND HALLS OF ASSEMBLY.

A Report rendered by the Section of the Suffolk District Medical Society "On the Practice of Medicine and Hygiene,"

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[Read at the Monthly Meeting of the Suffolk District Medical Society, May 25th, 1867.]

THE paper which the Committee submit to the Section treats not only of the hygrodeik, but of the proper manner of procuring the requisite hydration in heated air.

The true value of the instrument must be found by comparing it with the other hygrometers whose use is recognized, and by testing the accuracy of its chart with the formulæ and tables laid down by physicists. Thus it becomes necessary to look at the whole subject of hygrometry, with its attendant apparatus.

The object of hygrometry is to determine the quantity of watery vapor contained in a determined volume of air. This quantity is very variable. In our climate, perhaps, the air is absolutely never saturated with vapor, nor is it ever absolutely dry; for, at all times, if hygrometric substances, that is to say, those whose affinity for water is very great, such as chloride of calcium or sulphuric acid, are exposed, they are found to absorb moisture.

Air is rarely if ever saturated; but the relation which exists between the actual amount of moisture prevailing in the air with what would exist if the air was absolutely saturated, the temperature being the same in each case, gives us the hygrometric state—the fraction of saturation.

The degree of the air's humidity does not depend on the mere amount of moisture contained in it, but on its distance more or less from the point of saturation. Air, when cold, may be very humid with little moisture, and very dry, on the contrary, with a larger amount of vapor, when it is hot. Thus, for example, the air contains, as a general thing, more water in summer than in winter; yet it is less humid, owing to the fact that as the temperature is raised, so does the moisture fall away from the saturation point. Likewise

in heating rooms we do not diminish the quantity of moisture in the air present, but we lessen its humidity as we drive it further from its point of saturation.

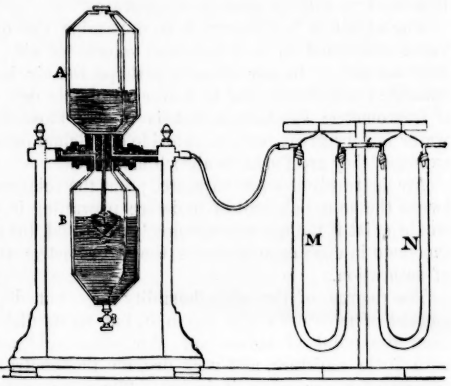
Indicating the saturation point of air at any given temperature by the number 100, we have a standard established for comparison, when ascertaining the quantity of moisture actually present in any specimen of air.

Upon ascertaining the amount so present, it may be indicated by a number which will bear the same relation to 100 that the amount found present bears to the amount which would be present if the air were completely saturated, or contained moisture to the full extent of its capacity.

And in such a case the number indicating the quantity present is called the relative humidity of the air examined.

Hygrometers are instruments which aid us to determine the hygrometric state of the air. A large number have been contrived, though they may all be separated into three kinds, according to the principles upon which they are planned and work: thus, we have hygrometers by chemical action, also by absorption, by condensation; and the dry- and wet-bulb thermometers, or the psychrometer.

The process of the hygrometer through use of chemicals, consists in passing a known volume of air over some substance greedy for moisture, such as the chloride of calcium. This substance having been weighed before the air is passed over, is again weighed after its passage. The increase of weight is that of the moisture in the air.



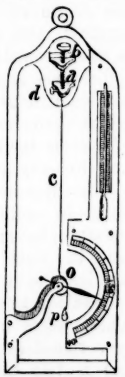
The apparatus is thus arranged. Two reservoirs, alike in construction and capacity, are attached opposite each other to an axis, round which they can revolve. They communicate with each other by a channel through the axis, while they by two channels in the axis are always in communication—the lower reservoir with the atmosphere, and the upper by means of rubber tubing with a series of **U** tubes (M and N), which are filled with chloride of calcium. The first of

these tubes (N) absorbs the moisture of the air inspired; the second (M) arrests the moisture which tends to pass from the reservoirs into the tube (N). The lower reservoir being full of water, the upper full of air, their position is transposed, so that the water in (A) may flow into (B). As a vacuum is thus forming in (A), air enters by the tubes (N) (M), in the first of which all the moisture is absorbed. When all the water has run into (B), the reservoirs are again revolved—the same process is repeated.

In this way, if the capacity of each reservoir is ten litres, and they have revolved five times, fifty litres of air have traversed the tube (N), and been dried. If before the operation the tube and its contents are weighed, and if it is weighed after, then the increase of weight gives the amount of moisture contained in fifty litres of air at the time the experiment was made.

From this weight, with the aid of calculations, the hygrometric state of the air is found. This process is the most precise, but it does not offer that degree of simplicity necessary in meteorological observations.

Hygrometers of absorption are based on the property that certain organic substances have of being lengthened by humidity and shortened by dryness. Many of these have been made. The one most generally used is the hair hygrometer of Saussure, the physician who planned it. This instrument is composed of a copper frame upon which is stretched a hair which has been thoroughly cleansed of all fatty matter, either in water containing one hundredth part of its weight of the subcarbonate of soda, or by placing it twenty-four hours in a bath of sulphuric ether. If the fatty matters are not removed, the hair absorbs but little moisture, and its increased length will hardly be perceptible; when it has been cleaned thoroughly, it lengthens rapidly as it passes from an arid to a humid state.



One end of the hair is confined in a pair of arms *(a)*, which may be raised or lowered by a screw *(b)*, thus stretching or relaxing the hair. The lower end is attached to one roller of a double pulley *(o)*; round the other roller winds, in a direction opposed to that of the hair, a silk thread with weight attached *(p)*. The axis of the pulley carries a needle, which moves over a graduated scale. When the hair contracts, the needle is raised; when the hair relaxes, the weight draws down the needle.

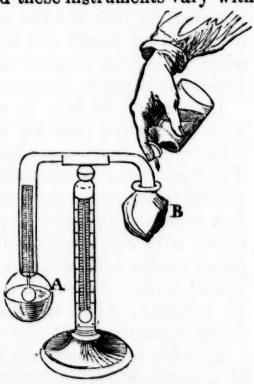
In order to graduate the scale, zero is marked at a point where, in ordinary temperature, the needle stops in air completely dry, and 100 at a point where it halts in air saturated with moisture. The interval between these points is divided into 100 equal parts, which are the degrees of the hygrometer.

The zero, or extreme dry point, is determined by placing the hygrometer under a bell-glass, and then drying the air by chloride of calcium or calcined carbonate of potash. The air of the bell-glass loses its humidity, and as the hair shortens it turns very gradually the pully and its needle. After fifteen to twenty days the needle becomes stationary, and the zero-point is given. To obtain the point of extreme humidity, the absorbents are removed from the bell-glass, and its walls are wet with distilled water. This soon saturates the air of the glass; the hair lengthens, the weight turns the needle, giving the 100-point, as it becomes stationary, in less than two hours. No matter what the temperature may be, the hygrometric needle returns in perfectly dry air to zero—in saturated air to 100.

There are many objections to these hair hygrometers. Made with different kinds of hair, their indications may vary many degrees, though they agree at the two extreme points of zero and 100. Moreover, the same hygrometer cannot be compared with its previous markings, as the hair will lengthen gradually merely from the weight *(p)*. Nor can you obtain immediately the degree of relative humidity.

Experiments showed that the indications of the hair hygrometer were not in proportion to the hygrometric condition of the air. Thus, when the needle marked 50 degrees, the air was far from being half saturated. Guy-Lussac then arranged a table by which these errors were corrected; this table shows that the air was half saturated at 72 degrees.

Guy-Lussac considered his table applicable to each and all hair hygrometers, but M. Regnault discovered these instruments vary with the origin of the hair, its color, its fineness, and the manner in which it was cleaned; so to secure precise indications it was necessary to have a table arranged for each instrument, which shows how incomplete this kind of hygrometer is, and what uncertainty and difficulty attend their use.



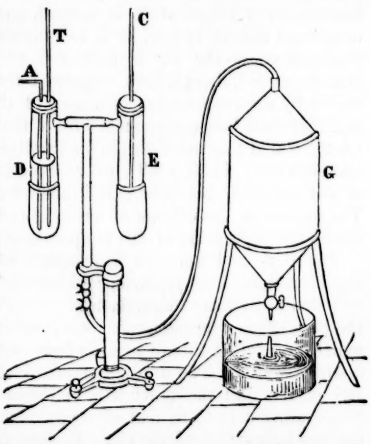
The hygrometer by condensation shows by cooling the air at what temperature its moisture suffices to saturate it. Such are the hygrometers of Daniell and Regnault.

Daniell's hygrometer consists of two glass globes united by a tube twice bent round at a right angle. Globe (A) is two thirds full of ether, into which a thermometer contained in the tube dips. The tube and globe (B) contain the vapor of ether; (B) is enveloped in muslin, on which ether is poured, drop by drop. This, evaporating, cools the

globe, condenses the vapors contained in it, when immediately globe (A) gives off more vapor, which is condensed in the upper globe, and so on. As the liquid distils from the lower globe into the upper one, the ether contained in the first cools, and the moment arrives when the air in contact with the globe (A), which cools with it, reaches a temperature when the moisture it contains is sufficient to saturate it. This moisture condenses and is deposited on the globe (A) as a layer of dew, in the form of a ring which surrounds the surface of the liquid, where especially the cooling process of evaporation takes place. The inner thermometer indicates this instant the temperature of the dew-point; that is to say, the temperature of saturation of the ambient air.

To determine more accurately this point, the temperature is taken when the precipitated moisture disappears by heating, and the mean then is taken between this temperature and that of the dew-point. The temperature of the air is given by a thermometer on the stand of the apparatus. The tension *f* corresponding to the temperature of the dew-point is then found in the tables of tensions arranged by Regnault; this tension is exactly that of the vapor present in the air at the time of the experiment. The tension F of vapor saturated at the temperature of the atmosphere is found by means of the same table. The quotient obtained by dividing *f* by F represents the hygrometric state of the air.

Daniell's hygrometer furnishes many causes of error:—1st. The evaporation in the globe (A) only cooling the surface of the liquid, the thermometer dipping into it cannot give precisely the dew-point. 2d. The observer being close to the apparatus, modifies the hygrometric state of the surrounding air as well as its temperature.



Regnault's hygrometer avoids the causes of error which are found in the last apparatus. This instrument is composed of two silver thimbles, with thin and polished walls. Two glass tubes (D) and (E) fit into these thimbles. Each holds a very sensitive thermometer fixed in place by a perforated cork. The cork of tube (D) is traversed by a tube (A) open at each end, reaching the bottom of the thimble. The tube (D) communicates by the

standard of the apparatus, and by a leaden pipe, with an aspirator (G) filled with water. The tube (E) does not connect with the aspirator. It contains merely a thermometer to show the temperature of the air at the instant of the experiment.

The apparatus works in this way. The tube (D) is half filled with ether, then the stop-cock of the exhauster is opened. The water which fills it flows out, and the air in the tube (D) is rarefied. By atmospheric pressure air then enters by the tube (A); but as air cannot penetrate into tube (D) and into the exhauster except by passing through the ether, it evaporates a part of it, and cools it the more quickly, the more rapid the water flows.

A moment comes when the refrigeration causes a deposit of dew on the thimble, as in the hygrometer of Daniell. The thermometer (T) giving the temperature corresponding, we have the elements necessary to calculate the hygrometric state.

In this instrument the entire mass of ether is at the same temperature, owing to its being agitated by the current of air passing through it; and as the observations are made at a distance, with the aid of a glass, every cause of error is avoided.

A much simpler form of apparatus may be constructed out of a common test tube, containing a depth of 1½ inch of ether; the tube is provided with a loosely fitting cork, in which is a delicate thermometer, and a narrow, bent tube dipping into the ether. On blowing through the ether by a narrow rubber tube of considerable length, a diminution of temperature is caused, and the whole process can be conducted almost as well as in Regnault's complete apparatus. The temperature of the air is indicated by a free thermometer. Dr. Hutton, of Edinburgh, first suggested that the degree of cold produced by the evaporation of water in the air would depend upon, and therefore indicate, the moisture of the air. Leslie again very distinctly stated this principle (in his treatise "On the Relations of Heat and Moisture," 1813, p. 39), and reduced it to practice by covering one of the bulbs of his differential air-thermometer with wet muslin. The motion of the column of water towards the moist bulb of course shows the depression of the temperature of evaporation.

The dry- and wet-bulb hygrometer, called on the continent the psychrometer—from *psychros*, cold, and *metron*, moisture—is formed of two similar delicate thermometers placed in a gentle current of air; the bulb of one thermometer being covered with muslin, and kept moist by a cotton thread leading from a small reservoir of rain or distilled water. The dry-bulb thermometer indicates the temperature of the air; the other will be found to remain stationary at a temperature said to be that of evaporation, which is usually several degrees below that of the air. In saturated or moist air the thermometers read alike; the difference increases in some proportion to the dryness of the air, and may be used as a superficial measure of dry-

ness in many practical matters, such as the ventilation of dwelling houses, halls, plant houses, &c.

The dry- and wet-bulb thermometers having long been the ordinary working hygrometer of the meterological observations, Mr. Glaisher, of England, has paid much attention to the perfecting of the instrument in every detail. He has finally adopted a pair of very delicate thermometers about one foot long, and with small spherical bulbs of thin glass of about one fourth of an inch diameter; they are mounted on metal scales, graduated from 10° to +130° F., and fixed parallel to each other from two to four inches apart, upon a metal cross-piece. Care is taken that each pair of thermometers is as exactly similar as possible. The bulb of the wet thermometer is covered with thin muslin, round the neck of which is twisted a conducting thread of lamp-wick, common darning cotton, or floss silk; this passes into an adjacent vessel of water placed about three inches distant from the wet bulb, a little beneath it and on the opposite side to the dry-bulb thermometer. It is a very objectionable practice to place a long glass vessel between the thermometers, for the water will seldom be of the same temperature as the surrounding air, and will tend slightly to vitiate the readings of both thermometers. A short, narrow-necked bottle, from which but little evaporation will take place, is the best.

From observations of the dry- and wet-bulb thermometers, it is further possible by means of tables previously determined by experience, or calculation from *à priori* principles, to determine the existing tension of aqueous vapor and other hygrometric data.

A number of these tables now exist in use, varying more or less in their indications, as their respective authors not only made use of the different thermometers of Centigrade, Reaumur and Fahrenheit, but also started with formulæ by no means similar. The only instruments now recognized are the psychrometer and the dew-point instruments. For these instruments, tables have been formed from these formulæ by Ivory, August, Bohnenberger, Magnus Regnault, Haeghens, Apjohn, Glaisher, Coffin and Guyot.

The results, however, of M. Regnault's researches derived from a series of experiments conducted during many years with great care and equal skill, published in separated papers in the *Annales de Chimie et de Physique*, have obtained the confidence of most scientific men; increased by the additional force given them by the labors of Magnus, of Germany, whose conclusions are so similar that they may be considered identical. Prof. Guyot, in his valuable papers published by the Smithsonian Institute, judges these values ought to be used in our hygrometrical tables, as has been done in France in preference to the older and less reliable determinations on which they are based.

A new series of hygrometrical tables, based on Regnault's table of Electric Forces of Vapors, was published by Mr. Glaisher,

in London, in 1856. As, however, the psychrometrical table has not been computed from Regnault's formula, but by means of empirical factors, the results differ. Mr. Glaisher's deductions have been made from the combinations of all the simultaneous observations of the dry- and wet-bulb thermometers, with Daniell's hygrometer, taken at the Royal Observatory, Greenwich, from 1841 to 1854—with some observations taken at high temperatures in India, and others in Toronto.

The hygrometrical series, as collected and arranged by Guyot, consists of twenty-seven tables, arranged in three divisions. In the first are found ten tables, based on Regnault's hygrometrical constants, both in French and English measures, in two corresponding sets, for the use of the psychrometer, the dew-point instruments, and for computing the weight of vapor in the air. Being based on the best elements we now possess, he gives them for ordinary use. The second division contains the seven most important tables published in the Greenwich Observations, and Glaisher's extensive psychrometrical table. These tables are much used in England; the results obtained by them exhibit no inconsiderable differences with those derived from the preceding ones, and are indispensable for comparing these results. The third division furnishes the means of comparing the different values of the force and weight of vapor—especially those used in Germany.

The supposed great accuracy of many of these determinations has been somewhat shaken by the later experiments of Regnault (*Ann. Phys.*, 3, xv.), for he finds that the temperature of evaporation is not invariable, but sinks lower, the greater the rapidity with which the air surrounding the wet bulb is moving. He is thus led to doubt the soundness of August's assumption, that the stratum of air surrounding the wet bulb is always saturated and of the same temperature as the bulb, and he considers that the radiant heat falling on the bulb is an element not to be neglected. The ordinary formulæ may be considered sufficiently accurate as long as the velocity of the air does not exceed sixteen to twenty feet in a second. Mr. William S. Tevons, M.A., in his article upon Hygrometry, says he quite agrees with Dr. Drew (Practical Meteorology) that the problem of the dry- and wet-bulb thermometers is still quite open to fresh investigation.

The hygrodeik, or moisture indicator, is composed of a Mason's hygrometer, the dry- and wet-bulb thermometers, attached to the sides of a frame, which embraces the so-called deik, or chart. To this apparatus is attached a movable centre, with a pointer, so that it can be easily moved to agree with the temperature, or, in other words, with the upper end of the column of mercury of the dry-bulb thermometer. Upon this centre is placed a bent lever in such a manner that one of its arms shall be a pointer to be adjusted to the mercury of the wet-bulb thermometer, while the other arm shall be a pointer or index hand to move over the face of the diagram upon which is

marked the relative humidity, the dew-points, and the weight in grains of watery vapor in a cubic foot of air. The invention of the hygrodeik was the result of an investigation of the formulæ based on M. Regnault's elements, by which psychrometrical tables are calculated. This investigation was undertaken for the purpose of making a simple calculating machine for ascertaining the relative humidity, absolute amount and dew-point, when the temperature, and temperature due to evaporation, are known.

Temperature.	90	80	70	60	50	40	30	20	10
130°	126.10°	122.33°	117.75°	113.25°	108.33°	103.75°	98.25°	92·67°	87.00°
120	116.67	113.10	109.25	105.00	100.75	96.00	91.10	85.60	80.25
110	107.33	104.00	100.33	96.60	92.50	88.25	83.33	78.75	73.50
100	97.27	94.30	91.14	87.83	84.23	80.32	76.09	71.56	66.50
90	87.53	84.87	82.06	79.09	75.90	72.54	68.92	65.00	60.88
80	77.77	75.43	72.97	70.20	67.67	64.79	61.72	58.58	55.07
70	68.04	66.02	63.91	61.70	59.42	57.00	54.49	51.97	49.09
60	58.34	56.53	54.86	53.02	51.13	49.15	47.14	45 09	42.90
50	48.62	47.20	45.77	44.29	42.77	41.22	39.64	38.02	36.33
40	38.89	37.77	36.63	35.49	34.30	33.08	31.99	30.70	29.42
30	29.06	28.25	27.40	26.60	25.80	24.90	24.04	22.92	21.73

Dew Points.

Grs. per cub. foot.	*Dew Points.*	150°	140°	130°	120°	110°	100°	90°	80°	70°	60°	50°	40°	30°	20°	10°
66.09	150°	100														
59.69	145	90.3														
53.71	140	81.2	100													
48.14	135	72.7	89.4													
42.97	130	65.0	80.0	100												
38.19	125	57.7	71.1	89.1												
33.79	120	50.9	62.9	78.6	100											
29.76	115	45.0	55.4	69.2	88.0											
26.09	110	39.4	48.5	60.7	77.2	100										
22.77	105	34.4	42.3	52.8	67.3	87.2										
19.79	100	29.9	36.8	46.0	58.4	75.8	100									
17.14	95	25.9	31.9	39.8	50.6	65.6	86.6									
14.81	90	20.8	27.5	34.4	43.5	56.7	74.8	100								
12.76	85	19.3	23.7	29.6	37.7	48.9	64.4	86.1								
10.95	80	15.0	20.2	25.4	32.1	42.0	55.3	73.9	100							
9.37	75	14.1	17.2	21.5	27.7	35.5	47.3	63.2	85.5							
7.99	70	12·0	12.8	18.6	23.3	30.6	40.3	54.0	72.9	100						
6.80	65			15.8	20.1	26.0	34.3	45.9	62.0	85.0						
5.76	60			13.4	17.1	22.0	29.0	38.8	52.5	72.0	100					
4.86	55			11.3	14.3	18.6	24.5	32.8	44.3	60.7	84.5					
4.09	50				10.0	15.6	20.6	27.6	37.3	51.1	71 1	100				
3.43	45					13.1	17.3	23.1	31.3	42.8	59.6	83.6				
2.86	40					10.6	14.4	19.3	26.1	35.7	49.7	69.7	100			
2.37	35						11.9	15.9	21.6	29.6	41.2	57.8	82.8			
1.97	30						09.9	13.2	17.9	24.6	34.2	48.0	68.8	100		

After a thorough investigation of the formulæ, to ascertain the character of the lines of equal humidity and absolute amount, a method of plotting was settled upon, and a card similar to the one now in use for the dial of the hygrodeik was produced.

To connect this dial with the pair of thermometers by means of pointers mechanically united was a simple task, though one requiring a great many experiments.

To plot the dial of the hygrodeik, first raise the pointer on the

dry-bulb thermometer to the highest tenth degree of temperature possible on the instrument, for instance, 90°; then by turning the knob raise the left hand pointer to the same temperature on the wet thermometer, and the point at which the hand comes on the dial will be the point of complete saturation of the air for that temperature, or the relative humidity of 90°.

By looking at the table (on the preceding page), in the first column we find the different temperatures as indicated by the dry thermometer, and in the other columns the degrees of temperature given by the wet thermometer, that will give the relative written at the top of the table, on the line of temperature given in the first column.

Keeping the pointer at the same dry temperature, move the hand until the pointer on the wet thermometer is successively at the temperature shown in the table, below the degrees of relative humidity, and mark the different points on the dial. For the other temperatures, move the right hand pointer ten degrees below, and proceed as before. Now, having the points at which the lines of relative humidity cross the lines of temperature, and connecting them by a curved line, we have the desired lines at every ten degrees of humidity, when the intermediate lines may be easily drawn in.

To find the dew-point lines, we will take the dial prepared as above described, and for the illustration of the method of plotting the lines, we will take the line which terminates on the line of complete saturation at 30° of temperature. Looking at the table, in the column headed Dew-points, we find 30°, and opposite to that in the column headed 90° is the number 13.2; this number represents the relative humidity of the air at a temperature of 90°, which contains the same number of grains per cubic foot as air at a temperature of 30°, the relative humidity being 100°.

The next number reading to the right is 17.9, which, being in the column of 80°, should be marked on the dial on the temperature line of 80°. The other numbers we mark on the temperature lines corresponding to the columns in which the numbers are found. Connect the points marked as above described by curved lines, and we have the dew-point line of 3°.

Proceed as above for the remainder of the lines, the last point in each line being the intersection of the line of complete saturation with the temperature lines.

In the first column of the table of dew-points will be found the absolute amount of moisture in the air; in other words, the number of grains of moisture per cubic foot of saturated air at the temperature shown in the column of dew-points.

Having thus described the instrument, it remains for us to close this part of our subject by giving the results of our investigations regarding its readings. We find, comparing its returns with the tables of M. Regnault, that when the wet-bulb thermometer stands at 30° to 36°, with difference of dry bulb reading from 2° to 10°,

its variations consist of from 2 to 3 and a fraction per cent. less than the tables of M. Regnault in Guyot; with wet bulb from 40° to 80°, with difference of dry bulb from 2° to 11°, variations are from 0 to 2 per cent. less.

The dew-points are generally nearly correct, though with an occasional difference of a degree. At the lower grades the difference is greatest. The weights of watery vapor only differ by a decimal.

The maker, Mr. Lowe, expressly states that a difference of two per cent. in returns is acknowledged and demanded for the instrument—a trifling amount for the purpose for which we require it.

The instrument, as it is now presented, is essentially a commercial one—distinctly for common, ordinary every-day use—and its results are generally sufficiently accurate.

If required for strictly scientific research, with more minute results, one can be made more exact.

The simplicity of this instrument, the ease with which it is worked, and the ready readings it affords, must be apparent to all.

The Committee would call especial attention to the line marked *health* on the chart, as this would lead many into error. The public will be likely to think that the air is healthy when the pointer is at this point. This is by no means true. It refers merely to the amount of moisture which it may be considered desirable to have, but not that the air, even when possessing this amount of humidity, is necessarily wholesome; for we all know that the air may be humid, yet totally unfitted for respiration. For example, the Black Hole of Calcutta, with its frightful history. The hygrodeik bears merely upon the air's humidity, not on the absence or existence of deleterious matters in the atmosphere.

[To be continued.]

Foreign Correspondence.

VIENNA, July 15, 1867.

MESSRS. EDITORS,—A short account of the aural clinics in the University of Vienna may perhaps be of interest to some of your readers, and serve to show the amount of work which is now accomplished in aural surgery. There are here two distinct courses of lectures united with clinical demonstration on the ear, its anatomy, pathology and treatment. One of these is that of Dr. Adam Politzer, which is held in the wards of Prof. Oppolzer, and the other that of Dr. Joseph Gruber, who has the regular ear-clinic of the General Hospital and lecture rooms of his own.

The number of patients attending each of these clinics varies from ten to thirty-five daily, more than enough for the elaborate clinical teaching which one finds so universally throughout the German

schools. Although differing somewhat in the minutiæ of examination and treatment, the general teaching of each is the same.

In examining the tympanum, Dr. Gruber uses a metallic speculum, shaped like two truncated cones placed one above the other; the larger and more obtuse cone forms the upper third of the speculum, while the very acute cone forms the other two-thirds and serves for insertion into the ear. The larger cone is blackened on the inside, while the smaller retains its metallic lustre. Dr. Politzer, on the other hand, uses a speculum of hardened caoutchouc, tunnel-shaped, with a broad, expanding top.

Both use for illumination the daylight reflected into the ear by means of a small, slightly concave, hand-mirror with a hole in the centre, through which the observer looks. In applying the air-douche Politzer uses what he calls his new mode of proceeding (neues Verfahren) i. e. injecting air suddenly into the closed nasal cavity during the act of swallowing, except in those cases where there is an obstruction of, or he wishes to inject medicaments into, the Eustachian tube, when he uses the catheter. Gruber, on the other hand, uses the catheter in all cases except those of children, in whom it is impossible. With children he injects air into the closed nose; unaccompanied, however, by the act of swallowing, as he claims that in them the orifice of the Eustachian tube is more open than in adults, and therefore the act of swallowing to open the tube is unnecessary. With both there is an excellent opportunity to see and learn the manipulation with the catheter, and in the many cases in which it is used one never sees the least ill effect.

The following statistics from the reports of Dr. Gruber to the Direction of the Hospital, will show what has been done in his department during the last two years.

The whole number treated by him was 678 in 1865, and 710 in 1866. Of these, 515 are reported cured, 221 improved, 154 unimproved by treatment, 190 examined and on account of the impossibility of cure discharged without treatment, while 150 and 155 respectively remained under treatment at the end of each year. 470 had diseases of the external ear, 576 of the middle ear, and 324 of the inner ear.

The diagnosis in the principal cases is given as follows: chronic catarrh 391, affections of the labyrinth 263, collections of cerumen in the ear-passage 171, acute catarrh 129, otitis externa diffusa 109, otitis externa circumscripta 42, acute inflammation of tympanum 38, chronic catarrh with polypi 35, otitis interna 24, deaf and dumb 30, chronic inflammation of the tympanum 20. Of the cases of chronic catarrh 65 were completely cured and 109 improved; of the affections of the labyrinth 2 were cured, 35 improved and 115 not treated. Of 129 cases of acute catarrh 76 were cured, 13 improved, and the remainder continued under treatment; of 109 of otitis externa diffusa 66 were cured and the remainder continued under

treatment; of 38 of acute inflammation of the tympanum 24 were cured and 8 remained; of chronic catarrh with polypi 11 were cured, 10 improved and 11 remained under treatment; of otitis interna 10 were cured, 7 improved and 5 still under treatment. Of the deaf and dumb 1 is reported cured, 13 not improved by treatment, 11 not treated, while 11 remained under treatment.

The report also contains an analysis of the cases which have been under observation and many valuable hints on treatment.

Of foreign bodies in the ear all have been removed by syringing; several cases are reported of injury to the ear by attempts at removal with instruments. In one case the apex of a pyramidal-shaped stone had been driven through the tympanum, producing inflammation of that membrane; in others the attempts at extraction had brought on a chronic inflammation with formation of granulations, which imbedded and held fast the foreign body. In these cases no attempt was made to extract immediately, but the inflammation was first completely reduced and then the foreign body syringed out; in one case over three months were required to subdue the inflammation.

Collections of cerumen are considered often due to a disease of the ceruminous glands, and after their removal the patient is directed to paint the ear-passage for a long time with a solution of iodide of potassium in glycerine. In many cases it is found, after the removal of the mass, that there are changes in the tympanum which require further treatment, so that the physician should be careful not to lead the patient to expect too much from the mere removal of the obstruction. In otitis externa a deep scarification of several parts of the meatus is strongly recommended, if the patient is seen in the early stage of the disease; even if there is only slight redness, this is advisable to relieve the pain and to prevent the further advance of the disease. In the majority of cases of otitis externa diffusa that run their course, the tympanum is found to be thickened or perforated.

Every case of inflammation of the tympanum came to perforation within ten days, and in one case the entire membrane was lost in a much shorter time. Almost all of these perforations, however, afterwards cicatrized, and this favorable result is attributed to non-interference. Dr. Gruber says, "Experience has taught me that doing too much may injure more than doing too little. On this account as soon as the exudation is secreted in less quantity, I avoid every application, allow syringing only in the most pressing cases, and leave nature free to use her healing power."

In speaking of perforations of the tympanum, which have become permanent, two interesting cases of relief by an operation proposed by himself are mentioned. In one of these there was a perforation a line in diameter, in the right tympanum, the result of chronic catarrh, to exacerbations of which the patient was still subject. By the aid of direct sunlight fifteen slight cuts were made around the edge of this perforation, an inflammation of the tympanum was excited,

during which cicatricial tissue was formed, and the perforation finally healed. The case was under observation over three months, and at the end of this time the hearing had somewhat improved, and the patient will, says the report, no more be troubled with inflammation. In the other case the perforation after the operation cicatrized completely, and the hearing decidedly improved; for the watch from contact with the ear to the distance of two and a half feet.

Of 169 cases of chronic catarrh during the last year, 66 led to perforation of the tympanum of both ears, and 16 to perforation only on one side. Only those cases are reported cured in which the patient regained the *normal* hearing power and was entirely freed from noises in the ears.

Twice that form of perforation was observed where the tympanum is separated from its insertion into the walls of the meatus. Where there was a stricture of the Eustachian tube, bougies of laminaria digitata were used with great benefit. Where there was catarrh of the nasal cavity, mild astringent solutions were syringed into the nose, and then with closed nostrils and mouth the patient was directed to make the motion of blowing the nose; in this way the fluid is forced into the Eustachian tube and distributed over the surface of the nasal cavity. This method is particularly recommended in syphilitical cases where any slight abrasion of the mucous membrane made in passing the catheter would be liable to ulcerate.

In most cases of chronic catarrh it is found that the perforation begins to cicatrize as soon as the secretion of the mucous membrane decreases.

The troublesome noises in the ears, of which patients complain so bitterly, after their power of hearing has been greatly improved, have been often found to cease suddenly without any known cause, and in like manner sometimes the hearing is suddenly and wonderfully improved without the surgeon being able to recognize the changes which have taken place in the ear.

Very truly, J. Orne Green, M.D.

THE BOSTON MEDICAL AND SURGICAL JOURNAL.

BOSTON: THURSDAY, AUGUST 22, 1867.

Dr. J. Mason Warren is no more! The third of an illustrious line of surgeons has departed. His death, which was from internal cancer, complicated with intussusception, and which had been for some time sadly anticipated, took place on Monday, August 19th, at his residence, 2 Park St. Dr. Warren was 56 years of age at the time of his decease.

It is not for us to speak his eulogy here. But, in common with the entire medi-

cal profession in both hemispheres, we mourn an irreparable loss. We yield to none in appreciation of his worth—his remarkable, and, we may say, hereditary surgical skill; his faithfulness to his duties, alike among rich and poor; his constant courtesy; his public spirit; his readiness to advance the interests of the profession, by giving freely of his time and means.

His professional brethren are proud to have been represented by such an associate as Dr. Warren; and profoundly lament that it was not granted to him to live, in activity and usefulness, to the threescore years and ten, or the fourscore years, allotted as the measure of man's days. But, we bow to the decree of Infinite Wisdom.

CLASSICAL AND UTILITARIAN STUDIES AS PREPARATORY TO THE MEDICAL SCHOOL.

Ne quid nimis.

On looking over the book entitled "Modern Inquiries," by Dr. Bigelow the elder, we notice that the two first articles in the order of arrangement are among the latest productions of the author's pen. We are not sure that this mode of juxtaposition does not represent the relative merits of the compositions. Alpha would seem to be Omega, and Omega to be Alpha. In other words, the fruits of Dr. Bigelow's riper years more than equal those of his prime. We do not forget that the seer-ship of thirty-two years ago emitted sparks which kindled a revolution in the ideas of medical men. But, in the address on "The Limits of Education," and in that on "Classical and Utilitarian Studies"—the papers above alluded to—the range and comprehensiveness of thought and the elegance of diction are such that we are compelled to regard those monographs as at least among the most remarkable of their author's literary efforts.

A thorough classical scholar, the pages of ancient literature are still fresh in his memory, as when the Greek and Latin symbols first left their impress on his mind. It is one thing to keep a collection of quotations from the dead languages stored for use on public occasions, as the badge of a college graduate, and quite another to have the mind so imbued with classic lore—photographed on the negative of memory by the rays of mental light—that whenever a citation is required, the writings of Homeric poesy or Ciceronian rhetoric are brought clearly into view by the chemistry of association. No one, therefore, is better qualified than Dr. Bigelow to speak of the worth of classical learning. By means undoubtedly of the training derived from that, he has been enabled, amid the engrossing cares of his profession, to make himself master of various sciences, and to keep himself *au courant* with all. When, then, he addresses us upon the comparative value of classical and utilitarian studies, it behooves us to listen with attention. And, if at a time of life when men are wont to cherish the old and tried, instead of embracing the new and untried, he takes the lead in advocating innovations, we should give special heed to his counsels. We leave it to the theological scholar and the student of jurisprudence to settle the question as relates to their respective professions. It concerns us here to look at it with reference to the preparation necessary for the study of medicine.

We quote from the address "On the Limits of Education," read before the Massachusetts Institute of Technology:—

"It is the object of the present remarks to show that the amount of knowledge

appropriate to civilization which now exists in the world is more than double, and in many cases more than tenfold, what it was about half a century ago; and that, therefore, no individual can expect to grasp, in the limits of a lifetime, even an elementary knowledge of the many provinces of old learning, augmented as they now are by the vast annexations of modern discovery. * * * If in the days of the ancient Greeks 'life was short,' while 'art was long,' how is it now, when life is not longer, but art, literature and science are immeasurably greater? * * * A law which obtains in matter, obtains also with regard to the mind and its acquirements, that strength is not increased in proportion to magnitude. The static and dynamic strength of materials for the most part decreases as their bulk increases. A column or a bridge cannot be carried beyond a certain size, without crushing or breaking its subtance; and a whale, if unsupported by the surrounding water, would die from the pressure of his own weight. A small animal will leap many more times his length than a large one; and the integrity of his slender limbs will not be injured by the exertion. The useful development of a tree is known to be promoted by severe pruning; and where this is impossible, as in primeval forests, the trees prune themselves, and attain greater height by the death of their under branches, the insufficient supply of sunlight being monopolized by the upper and dominant members at the expense of the lower. These examples, drawn both from inert and organic matter, may serve to illustrate the corresponding truth, that human intellect, though varying in capacity in different individuals, has its limits in all plans of enlargement by acquisition; and that these limits cannot be transcended without aggregate deterioration in distracting the attention, overloading the memory or overworking the brain, and sapping the foundations of health. * * * Subdivision and selection afford the principal avenues through which men arrive at success in the humbler, as well as the more conspicuous walks of life. The mechanical labor of artizans is best performed, and its best results obtained, by distributing its duties among a multitude of special agents; and this is more or less successfully done, in proportion as a society or a craft is more or less perfectly organized. So likewise in the higher or more intellectual pursuits of life, in which men procure bread by the labor of their heads instead of their hands, the number of learned professions has been within a short time wonderfully increased. In the days of our fathers, the learned professions were accounted three in number—Law, Physic and Divinity. But now more than three times that number afford means of honorable subsistence to multitudes of duly educated persons. * * * I would not underrate the value or interest of classical studies. They give pleasure, refinement to taste, depth to thought, and power and copiousness to expression. Any one who, in this busy world, has not much else to do may well turn over, by night and by day, the *exemplaria Græca*. But if, in a practical age and country, he is expected to get a useful education, a competent living, an enlarged power of serving others, or even of saving them from being burdened with his support, he can hardly afford to surrender four or five years of the most susceptible part of life to acquiring a minute familiarity with tongues which are daily becoming more obsolete; and each of which is obtained at the sacrifice of some more important science, or some more desirable language. It may not be doubted that a few years devoted to the study of Greek will make a man a more elegant scholar, a more accomplished philologist, a more accurate and affluent writer, and, if all other things conspire, a more finished orator. But of themselves they will not make him what the world now demands—a better citizen, a more sagacious statesman, a more far-sighted economist, a more able financier, a more skilful engineer, manufacturer, merchant or military commander. They will not make him a better mathematician, physicist, agriculturist, chemist, navigator, physician, lawyer, architect, painter, or musician. The ancient Greeks knew but little, though they knew how to express that little well. The moderns know a great deal more, and know how to express it intelligibly. Antiquity has produced many great men. Modern times have produced equally great men, and more of them."

From the paper "On Classical and Utilitarian Studies," we select the following passages:—

"The first three centuries of the Christian era had before their eyes the light of the classics and the wisdom of the ancients; but they went steadily from bad to worse. The last three centuries have had modern literature and the useful sciences and arts, and have gone steadily from good to better. * * * Great stress has been laid, by the more exclusive advocates of classical studies, on the peculiar fitness and efficacy of those studies for training the minds of young students, and developing, enlarging and strengthening their powers, irrespectively of any application to other use. That such an efficacy does exist in these studies no one will probably deny; but it does not follow that such training is superior to all others, or that it promotes the greatest economy of the time of young persons destined to various pursuits of life. Education, in its largest and most liberal sense, involves two things. It means not only the development of the mind, but also the acquirement of useful knowledge, 'by which every rising generation is put in possession of the attainments of preceding generations, and becomes capable of increasing and improving this inheritance.' It is not enough that the prime of youth should be spent in developing the mind, or in learning how to learn. It is much better to have combined together the instrument and the object, the process and a useful result. An ignorant man or child might develope his mind somewhat by studying the Algonquin language or the science of heraldry, or by making himself familiar with the Talmud, the Koran, or the Mormon revelation; but if, on the other hand, he should have devoted the same time to acquiring the French language, or the science of chemistry, or a salutary code of ethics, he would have a doubly valuable result to show for his labor. It is the same as in physical education, where he might develope and increase his muscular strength by continually picking up stones and laying them down again. But if he should lay them down in some mode of useful construction—a wall, for instance—or should remove them to another place, where they would do more good or less harm, he would have not only improved his muscles, but by the same act would have created a valuable property. * * * Few persons now deny, that the study of the ancient languages and ancient authors assists to fill and to strengthen the mind, to enlarge the sphere of thought, and to improve, polish and amplify the power of expression. It has also the present prestige of acquired currency in the educated world, and may well form a constituent part of the most acceptable as well as liberal culture. But it should not monopolize the room which is now too scanty for other indispensable pursuits. Classical learning, like music and painting, will refine, delight and elevate the mind of a susceptible person; but it will not bring him up to the intellectual demands of the present period. There are other things that, in this age and country, press upon his attention and time, in comparison with which classical learning is already obliged to be subordinated. No man now quotes Greek and Latin in the pulpit or on the stage, in Congress or in a popular assembly. But it will not do for an aspirant for social influence or distinction to be ignorant of the great moving-springs and channels of modern industry and progress, of the science of government, the constitution of his own country, the laws of society and of nations, the geographical, social and commercial relations of the world, the leading questions of finance and political economy, the properties of bodies and their values, uses, aptitudes, relations and actions upon each other. He should not be ignorant of the laws of animal and vegetable life, or of the sources of agricultural and mineral wealth. These, with moral science, modern languages, and the vast domain of English literature, may profitably replace much of the labor and time now expended in colleges on the hypertrophy of classical learning."

We think the tide has turned against the too exclusive devotion of time to classical studies, which has so long prevailed here, and which still holds despotic sway in England. The world has indeed begun to outgrow the knowledge and culture of the ancients. The classical exactions of the day, while they have their appropriate office, have often failed to give full play to the faculties. The grinding of the wits upon the verbal niceties of Latin and Greek may sharpen, but does not greatly expand the mind. Proficiency in the dead languages fits

men for Oxford "Fellowships," and coteries of literary *dilettanti*, which have no counterpart or place in this busy country. Hence, it has been the wont of indolent and pleasure-seeking undergraduates to console themselves for their remissness by pointing to the occasional obscurity in after life of the first scholars in our colleges.

Save for a few who may choose to make the classics a specialty, the tendency now is to give to all who enter Harvard University (and the other collegiate seminaries must follow its example) a thorough groundwork in Latin and Greek, but beyond that, and to the many, a good reading knowledge merely, and understanding of the spirit of ancient authors. After the Freshman year, the study of the dead languages is now optional. On the other hand, French is required to be learned from the outset. German is thoroughly taught. A reading knowledge of Italian and Spanish is given. These, with the physical sciences in increasing measure, mathematics, logic, metaphysics, English composition, *et id omne genus*, are fast becoming the staple of instruction.

Here we have, as we conceive, such a preparation for the study of medicine as is best suited to the great majority of its followers—in which number we include the general practitioner; the clinical observer and lecturer; the teacher; the votaries of pathology, comparative anatomy and physiology; the students of medical jurisprudence and of insanity.

A more exclusively scientific course, such as obtains at the Massachusetts Institute of Technology (the establishment of which institution may perhaps have had a share in hastening the innovations at Cambridge) is, it strikes us, well adapted to those who intend to make the study of medicine a stepping-stone to certain special pursuits, as, for instance, animal chemistry, toxicology, pharmacology, &c.

We stop the press here, and exclude all other editorial matter, to give place to an account of the proceedings at a special meeting of the Suffolk District Medical Society, with reference to the death of Dr. J. Mason Warren.

The meeting was held yesterday, Dr. Ayer, the Vice-President, in the chair. After appropriate introductory remarks by Dr. Ayer, Dr. Putnam, the attending physician of the deceased, at the request of the chair, gave an account of the last illness of his distinguished patient. A full report of the case will be furnished us by Dr. Putnam hereafter.

Dr. O. W. Holmes then presented the following address and resolutions. The latter were unanimously adopted, and both ordered to be printed.

It was voted that the Society attend the funeral of Dr Warren.

Dr. Holmes's Remarks.

A little more than ten years ago some of us, and some who are no longer with us, met to do honor to the memory of JOHN COLLINS WARREN, who, having filled the measure of his days, had yielded to the summons which no art can delay beyond its appointed hour. It seems to us too soon to roll back the stone from the mouth of the sepulchre that received the father, to admit the son. He was still in the years of ripe but not decaying manhood. We should have asked that his life might have been prolonged like his father's, so that he might have seen the near approach of the twentieth century. But God knows best when he has done with his servants, and though our friend was called away before the evening shadows had closed around him, he had done a full day's work when he found rest from his earthly labors. It is not for him that we would have asked length of days to be his portion, but for those whom he has left, who find it hard to lose the years they had hoped remained for him.

For nearly thirty-five years I have known Dr. Mason Warren, at home and abroad, as a student and as a practitioner, professionally and socially, as a com-

panion and as a friend. I have studied with him, consulted with him, travelled with him; we have worked together and enjoyed many pleasures in each other's company. The record that I can here trace of him must be very brief, but it is one that will only do him honor.

His health was somewhat impaired during his residence at college, so that he was unable to complete his academic course, which would have made him a graduate in 1830. He therefore began the study of medicine in advance of those who were before him in college, and when I reached Paris in 1833, I found him already established there as a student, having taken his medical degree in the previous year. He was no longer an invalid, though never very robust, but labored as diligently as the strongest, and took a part in every social enjoyment with his young companions.

In Paris, in London, wherever we found ourselves, he never for a moment lost sight of his great object—to qualify himself for that conspicuous place as a surgeon which was marked for him by the name he bore and the conditions to which he was born. This was his constant aim in the hospitals which he assiduously followed, in the museums which he faithfully explored. In the society of the distinguished practitioners to whom he had access and to whom he often introduced his less favored friends, though always at his ease, and good company for any he might meet, he was still listening and learning. He was often playful; he had a delightful vein of humor, he was a pleasant narrator of incidents, he was genial and hearty, as if he lived only for society, but he could not be long turned aside from his serious and manly duties. This is the reason why he took his place so soon and so easily on his return, and not merely because a place was ready for him. It demanded no small qualifications to fit a man to bear up the name of Warren in the third generation, and never to allow it to sink below the standard mark.

We who knew this laborious man loved him, because he was kind and good and natural in all his ways. I do not remember that any one of us, even of those who travelled with him—and travelling in company is the touchstone of infirm tempers—ever had a hard word with him. Yet he was what we should have called a man of a high spirit, and there was some fiery blood in his veins, such as Joseph Warren shed in that fierce *melée* which opened the war of the Revolution. He was so well bred, so uniformly courteous, that none but a churl would have found it easy to make a quarrel with him, and the churl would have seen that there was a strong manhood beneath his good nature that would not be safely tampered with. And with his good nature he united that good sense which a wise man has said is rarer than genius.

His labors in the profession will be long remembered. This generation will miss his great experience and his cunning hand; those coming after us will often hear his name joined with those of his distinguished father and grandfather, as constituting an unbroken line of hereditary excellence such as history but rarely shows.

It has been most happy for his fame that he lived to complete that noble volume containing the record of his surgical practice, which bears the date of this very year 1867. How full of valuable observations, plainly and simply told, for he made no unnecessary show of words in telling the most startling cases that came before him, this important work is, many of you know well. Almost everything which has been dared in surgery is there set down from his own experience. No matter what the gravity of the case, or the brilliancy of his success, whether the tying of both carotids or the extirpation of the upper maxilla, or amputation at the hip-joint, it is all told without expletives, without notes of admiration, in all the dignity of true science—told as the engineer describes a section of the earth, as the astronomer describes the transit of a star.

It would have been a pang to part with such a man, even when age had dimmed his eye and relaxed his strength; it is very hard to relinquish him with so much seemingly in prospect for him and through him for us.

But he has left us, we trust, for a serener sphere of being, and we seek our first solace in giving expression to our grateful recollections and our fond regrets.

I venture to propose to the Society the following Resolutions:—

Resolved, That by the death of Dr. J. Mason Warren, its late President, and associate from the time of its foundation, this Society has been deprived of the

counsel and the friendly presence of a member at once honored and beloved, who brought a sound knowledge, a large and wise experience and an ever willing helpfulness to its deliberations; who added liberally to its usefulness from the ample records of his practice; whose native dignity of character was so joined with engaging social qualities that he was always respected as a man and always welcome as a companion.

Resolved, That to the medical profession of this city and of this State the death of Dr. Warren, one of the most widely known and valued practitioners counted upon its rolls during the present generation, is a loss which will be deeply mourned by all its members; that his memory will be cherished by them as that of a fellow-laborer whose life was one long work-day of professional duty, and who yet found time to make many important contributions to the literature of a calling which he practised with a skill and success worthy of the illustrious name he bore.

Resolved, That the medical profession of this country and the great body of the healers of men throughout civilization have lost from their ranks one who honored their occupation by his personal character and bearing, who enriched their art by his invention, who illustrated its possibilities by his prudent boldness, who served its interests faithfully in life and bequeathed to it a record of experience full of instruction, which will be studied with profit, not only here and in our own day, but by students of other lands and in after times.

Resolved, That the members of this community, in the midst of which Dr. Warren has, for many years, exercised his beneficent office, have been deprived by his death of a counsellor of whom it is enough to say that he was to them what his father was to their fathers, what his grandfather was to their grandfathers—a master to control the resources of his art, a servant to obey the call of humanity.

Resolved, That this Society feels, and would desire respectfully to express, the profoundest sympathy with the family of its associate, our departed friend, and that it would place these words of heart-felt tribute before them, not as adequate marks of regret, but as an assurance that the grief of those nearest to him whom we cherish henceforth in our memory is shared by a wide circle of friends, who know how sorrowful the home must be which has lost one so worthy of love and honor.

VITAL STATISTICS OF BOSTON.

FOR THE WEEK ENDING SATURDAY, AUGUST 17th, 1867.

DEATHS.

	Males.	*Females.*	*Total.*
Deaths during the week - - - - - - - - -	40	50	90
Ave. mortality of corresponding weeks for ten years, 1856—1866	53.5	51.6	105.1
Average corrected to increased population - - - - - -	00	00	115.96
Deaths of persons above 90 - - - - - - - -	0	0	0

PAMPHLETS RECEIVED.—Transactions of the Medical Society of the State of Kansas, for the year 1867.—Annual Report of the City Registrar of the Births, Marriages and Deaths in the City of Boston for the year 1866.

MARRIED,—At Terre Haute, Ind., 13th inst., Dr. Chandler B. Braman, of Brighton, Mass., late Assistant Surgeon U.S.A., to Miss Cecilia O. Gage, of Terre Haute.

Died,—In this city, 19th inst., J. Mason Warren, M.D., aged 56.

DEATHS IN BOSTON for the week ending Saturday noon, August 17th, 90. Males, 40—Females, 50. Accident, 3—disease of the bowels, 1—disease of the brain, 2—bronchitis, 1—cancer, 1—cholera infantum, 26—consumption, 12—convulsions, 2—cystitis, 1—diarrhœa, 4—dropsy, 1—dropsy of the brain, 3—drowned, 1—dysentery, 5—scarlet fever, 4—disease of the heart, 2—infantile disease, 2—disease of the kidneys, 1—disease of the liver, 1—inflammation of the lungs, 2—marasmus, 3—old age, 1—paralysis, 2—premature birth, 1—scrofula, 1—smallpox, 1—disease of the spine, 1—tetanus, 1—unknown, 3—whooping cough, 1.

Under 5 years of age, 51—between 5 and 20 years, 9—between 20 and 40 years, 14—between 40 and 60 years, 9—above 60 years, 8. Born in the United States, 67—Ireland, 13—other places, 10.